Science Standards of Learning

Teacher Resource Guide

Kindergarten

Commonwealth of Virginia
Department of Education
Richmond, Virginia
2000

Kindergarten
Science Strand

Scientific Investigation, Reasoning, and Logic

This strand represents a set of inquiry skills that defines what a student should be able to do when conducting activities and investigations. The various skill categories are described in the "Investigate and Understand" section of the *Standards of Learning*, and the skills in science standard K.1 represent more specifically what a student should achieve during the course of instruction in the kindergarten. Across the grade levels the skills in the first standards form a near continuous sequence of investigative skills. (Please note Appendix, "Science Skills, Scope, & Sequence.") It is important that the classroom teacher understands how the skills in standard K.1 and K.2 are a key part of this sequence (i. e., 1.1, 2.1, 3.1, 4.1, 5.1, 6.1, and 6.2). It is also important to note that 25% of items on the 3rd and 5th grade SOL assessments measure the skills defined in the " Scientific Investigation, Reasoning, and Logic" strand.

Strand: Scientific Investigation, Reasoning, and Logic

Standard K.1

The student will conduct investigations in which

- basic properties of objects are identified by direct observation;
- observations are made from multiple positions to achieve different perspectives;
- a set of objects is sequenced according to size;
- a set of objects is separated into two groups based on a single physical attribute;
- picture graphs are constructed using 10 or fewer units;
- nonstandard units are used to measure common objects;
- an unseen member in a sequence of objects is predicted;
- a question is developed from one or more observations;
- objects are described both pictorially and verbally; and
- unusual or unexpected results in an activity are recognized.

Understanding the Standard

The skills defined in K.1 are intended to develop the investigative and inquiry components of all of the other kindergarten standards (i.e., K.2 –K.10). Standard K.1 describes the range of inquiry skills and the level of proficiency in using those skills that students should achieve in the context of science concepts developed in kindergarten. Standard K.1 does not require a discrete unit on scientific investigation because the inquiry skills that make up the standard should be incorporated in all the other kindergarten standards. It is also intended that by participating in activities and experiences that develop these skills, students will achieve a precursor understanding of scientific inquiry and the nature of science, and more fully grasp the content-related concepts.

Standard K.1

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · Observation is an important way to learn about the world. Through observation one can learn to compare, contrast, and note similarities and differences. · An object can appear very different depending on how it is oriented. To describe an object fully and accurately, it should be observed from several different positions. · Putting objects in a sequence allows one to understand how things are related. A sequence can show how things can change a little at a time. · Picture graphs are useful ways to display and report information. · A non-standard unit of measure, such as the length of a paper clip, can be used to describe and communicate the dimensions of an object. For the non-standard unit to be most useful, it should be consistent and easily applied.	In order to meet this standard, it is expected that students should be able to: · observe objects and describe their basic properties. These include: color, shape (circle, triangle, square), size (big, little, large, small), texture (rough, smooth, hard, soft), weight (heavy, light). · observe an object or objects from multiple positions to achieve different perspectives. In order to accomplish this, the student should look at the object from top, bottom, front and back. · arrange a set of objects in sequence according to size. · separate a set of objects into two groups based on a single physical attribute including size, color, texture, and weight. · construct picture graphs using 10 or fewer units. · measure common objects with nonstandard units. Examples of nonstandard units include hands, pennies, and paper clips. · predict an unseen member in a sequence of objects to complete a pattern.

Standard K.1 (continued)

Overview	Essential Knowledge, Skills, and Processes
· Observations about familiar objects or events often lead to the development of important questions that can spark further investigation. · Observations can be communicated through pictures and discussions. · It is important to observe the results of an investigation carefully. Results that are unexpected or unusual may be of interest for further study.	· develop a question from one or more observations. · describe objects both pictorially and verbally. · identify unusual or unexpected results in an activity.

Strand: Scientific Investigation, Reasoning, and Logic

Standard K.2

The student will investigate and understand that humans have senses including sight, smell, hearing, touch, and taste. Senses allow one to seek, find, take in, and react or respond to information in order to learn about one's surroundings. Key concepts include

- five senses (taste, touch, smell, hearing, and sight);
- sensing organs associated with each of the senses (eyes, ears, nose, tongue, and skin); and
- sensory descriptors (sweet, sour, bitter, salty, rough, smooth, hard, soft, cold, warm, hot, loud, soft, high, low, bright, dull).

Understanding the Standard

The second standard at the kindergarten level is very closely related to the inquiry skill of observation developed in K.1. This standard focuses on the senses – sight, smell, hearing, touch, and taste. Standard K.2 focuses on student understanding that each sensing organ is associated with a sense (eyes, ears, nose, tongue, and skin). It is important to emphasize that one should never taste, touch, or sniff something that's identity is unknown or has any potential danger.

Standard K.2

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · A particular sensing organ is associated with each of the five senses (eyes, ears, nose, tongue, and skin). · Using the senses we can make careful observations about the world and communicate those observations through descriptors.	In order to meet this standard, it is expected that students should be able to: · identify and describe the five senses (taste, touch, smell, hearing, and sight). · match each sensing organ with its associated sense (eyes, ears, nose, tongue, and skin). · match sensory descriptors with the senses (**taste**: sweet, sour, bitter, salty; touch: smooth, hard, soft, cold, warm, hot; **hearing**: loud, soft, high, low; **sight**: bright, dull, color, black and white.)

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Force, Motion, and Energy

The strand focuses on students understanding of what force, motion, and energy are and how the three concepts are connected. The major topics developed in this strand include magnetism; types of motion; simple machines; and energy forms and transformations, especially electricity, sound, and light. This strand includes science standards K.3, 1.2, 2.2, 3.2, 4.2, 4.3, 5.2, 5.3, 6.3, and 6.4.

Strand: Force, Motion, and Energy

Standard K.3

The student will investigate and understand that magnets have an effect on some materials, make some things move without touching them, and have useful applications. Key concepts include

- attraction/nonattraction, push/pull, attract/repel, and metal/nonmetal; and
- useful applications (refrigerator magnet, can opener, magnetized screwdriver).

Understanding the Standard

Magnets have an effect on certain metals and can cause objects to move without actually touching them. Standard K.3 focuses on developing a basic understanding of magnetism that will be expanded in standards 2.2, 4.3, and 6.4. It is intended that students will actively develop science investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

Standard K.3

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · Magnets will attract certain metals. · Magnets have an effect on some items, causing them to move. Some items are not affected by magnets and remain stationary. · Because some metals are attracted to magnets, they have many simple useful applications in the home. · The force of a magnet can move something that it does not actually touch.	In order to meet this standard, it is expected that students should be able to: · predict and test which common objects will be attracted to magnets. · classify objects as being attracted or not attracted to magnets. · explain in their own words essential vocabulary including the concept of attraction/nonattraction, push/pull, attract/repel, metal/nonmetal. · evaluate the importance and usefulness of magnets in the home. · identify items in the home that contain a magnet or magnets. (Example: refrigerator magnets.)

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Science Strand

Matter

The strand focuses on the description, physical properties, and basic structure of matter. The major topics developed in this strand include concepts related to basic description of objects; solids, liquids, and gases (especially water); phase changes; mass and volume; and the structure of classification of matter. This strand includes science standards K.4, K.5, 1.3, 2.3, 3.3, 5.4, 6.5, 6.6, and 6.7.

Strand: Matter

Standard K.4

The student will investigate and understand that objects can be described in terms of their physical properties. Key concepts include

- the eight basic colors;
- shapes (circle, triangle, square) and forms (flexible, stiff, straight, curved);
- textures and feel (rough, smooth, hard, soft);
- relative size and weight (big, little, large, small, heavy, light, wide, thin, long, short); and
- position and speed (over, under, in, out, above, below, left, right, fast, slow).

Understanding the Standard

Standard K.4 focuses on student understanding that all objects have physical properties, which include color, shape or form, texture, and size. Position and speed, though not physical properties, can be observed and described. A basic understanding of physical properties provides a foundation for observing, investigating, and studying matter. It is intended that students will actively develop science investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

Standard K.4

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · An object may have many properties that can be observed and described. · Objects can be described readily in terms of color, shape, and texture. · Two different objects can have some of the same physical properties and some different physical properties.	In order to meet this standard, it is expected that students should be able to: · identify and name eight basic colors. (Includes red, orange, yellow, green, blue, and purple. Knowing indigo and violet is not required at the kindergarten level. Though black and white are not spectral colors, students should recognize these by name.) · identify and name a circle, triangle, and square. · compare and contrast objects that are stiff, flexible, straight, and curved. · compare and contrast objects that are rough, smooth, hard, and soft. · compare objects using the concepts of heavy/light, long/short, wide/thin, big/little, and large/small. · measure objects using nonstandard units. · identify the position of an object using position words: over, under, in, out, above, below, left, right. · group objects according to their speed: fast and slow.

Strand: Matter

Standard K.5

The student will investigate and understand that water has properties that can be observed and tested. Key concepts include

- water occurs in different forms (solid, liquid, gas);
- the natural flow of water is downhill; and
- some materials float in water while others sink.

Understanding the Standard

Standard K.5 focuses on student understanding that water has identifying properties that can be observed and described. This standard serves as a basis for understanding physical properties and states of matter. Related primary standards include 1.3, 2.3, and 3.3. It is intended that students will actively develop science investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

Standard K.5

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · Water can be a solid, liquid, or a gas. · The form of water can be changed by heating or cooling it. · The natural flow of water is from a higher to a lower level. · Some objects float in water while others do not.	In order to meet this standard, it is expected that students should be able to: · identify the different forms of water (solid, liquid, and gas). · describe the natural flow of water. · predict where a stream of water will flow. · predict whether items will float or sink when placed in water. (Items to use include wood, metal, fruits, paper, and plastics.)

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Life Processes

The strand focuses on the life processes of plants and animals and the specific needs of each. The major topics developed in the strand include basic needs and life processes of organisms, their physical characteristics, orderly changes in life cycles, behavioral and physical adaptations, and survival and perpetuation of species. This strand includes science standards K.6, 1.4, 1.5, 2.4, 3.4, 4.4, and 6.8.

Strand: Life Processes

Standard K.6

The student will investigate and understand basic needs and life processes of plants and animals. Key concepts include

- living things change as they grow and need food, water, and air to survive;
- plants and animals live and die (go through a life cycle); and
- offspring of plants and animals are similar but not identical to their parents and one another.

Understanding the Standard

Standard K.6 focuses on student understanding that all living things have basic life needs and life processes. This standard introduces basic life science concepts that progress through high school biology. K.6 is very closely related to the concepts presented in 1.4 and 1.5. It is intended that students will actively develop science investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

Standard K.6

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · Plants and animals change as they grow. · Plants and animals need food, water, and air (oxygen) to live. (Many animals and plants that live in water use the oxygen that is dissolved in the water.) · Plants and animals live and die. This is part of the life cycle. · Many immature plants and animals are like their parents but not identical to them.	In order to meet this standard, it is expected that students should be able to: · describe the life needs of animals and plants. The life needs are food, water, and air. · predict what will happen to animals and plants if life needs are not met. · describe some simple changes animals and plants undergo during the life cycle. For animals this may include changes in color, body covering, and overall size. For plants this may include size, presence of branches, ability to produce flowers and fruits. · compare and contrast young plants and animals with their parents, using pictures and/or live organisms.

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Interrelationships in Earth/Space Systems

The strand focuses on student understanding of relationships within and among Earth and space systems. The topics developed include shadows; relationships between the sun and the Earth; weather types, patterns, and instruments; properties of soil; characteristics of the ocean environment; and organization of the solar system. This strand includes science standards K.7, 1.6, 2.6, 3.7, 4.6, 5.6, and 6.10.

Strand: Interrelationships in Earth/Space Systems

Standard K.7

The student will investigate and understand that shadows occur when light is blocked by an object. Key concepts include

- shadows occur in nature when sunlight is blocked by an object; and
- shadows can be produced by blocking artificial light sources.

Understanding the Standard

Standard K.7 focuses on student understanding that light produces shadows when objects block light. This is a key concept for student's future understanding of more complex Earth and physical science concepts such as night and day and eclipses. Within the primary grades related concepts are found in standards 1.6 and 3.8. It is intended that students will actively develop science investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

Standard K.7

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · A shadow is an image of an object created when light is blocked by that object. · Shadows can occur whenever light is present. · People can make shadows. · Living and nonliving things can make shadows.	In order to meet this standard, it is expected that students should be able to: · identify a shadow or variety of shadows. · describe how to make a shadow. · identify and describe sources of light – sun, electric lights, and flashlights - that can produce shadows. · match objects with the shadow they would create. · analyze how shadows change as the direction of the light source changes.

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Science Strand

Earth Patterns, Cycles, and Change

The strand focuses on student understanding of patterns in nature, natural cycles, and changes that occur both quickly and over time. An important idea represented in this strand is the relationship among Earth cycles and change and their effects on living things. The topics developed include noting and measuring changes, weather and seasonal changes, the water cycle, cycles in the Earth-moon-sun system, and change in the Earth's surface over time. This strand includes science standards K.8, K.9, 1.7, 2.7, 3.8, 3.9, 4.7, and 5.7.

Strand: Earth Patterns, Cycles, and Change

Standard K.8

The student will investigate and understand simple patterns in his/her daily life. Key concepts include

- weather observations;
- the shapes and forms of many common natural objects including seeds, cones, and leaves;
- animal and plant growth; and
- home and school routines.

Understanding the Standard

Standard K.8 focuses on student understanding of basic patterns in daily life. Careful observations of patterns help predict events. Patterns are found in weather; in natural objects including seeds, cones, and leaves; in the growth of animals and plants; and in daily routines. The basic kindergarten concepts related to patterns will be further developed in the primary grades, especially basic concepts of cycles, sequences, and rate. It is intended that students will actively develop science investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

Standard K.8

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · One can make simple predictions in weather patterns. On a cloudy, warm day, it may rain. On a cloudy day that is very cold, it may snow. On a clear day there most likely will be no rain or snow. · As animals and plants grow, they get larger according to a pattern. · Natural objects such as leaves, seeds, and cones have patterns we can see. · Home and school routines frequently follow a pattern.	In order to meet this standard, it is expected that students should be able to: · observe and identify daily weather conditions – sunny, rainy, cloudy, snowy, windy, warm, hot, cool, and cold. · predict daily weather based on basic observable conditions. · chart daily weather conditions. · identify simple patterns in natural objects – veins in a leaf, spiral patterns in cones, shapes and colors of common seeds. · identify and describe patterns in their daily schedule at home. · identify and describe patterns in their daily schedule at school. · distinguish between the patterns in home activities and school activities. · describe how animals and plants change as they grow. (Related to K.6.)

Strand: Earth Patterns, Cycles, and Change

Standard K.9

The student will investigate and understand that change occurs over time, and rates may be fast or slow. Key concepts include

- natural and human-made things may change over time; and
- changes can be noted and measured.

Understanding the Standard

Almost everything changes over time. Those changes can be observed and measured. Standard K.9 focuses on students understanding basic aspects of change, especially those things that can be easily observed and are within the experience of kindergarten children. Change is a key concept woven into most of the science standards throughout elementary, middle, and high school. It is intended that students will actively develop science investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

Standard K.9

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · Change occurs over time. · Change can be fast or slow depending upon the object and conditions. · As people grow they change. · Not all things change at a rate that can be observed easily. · Many changes can be measured.	In order to meet this standard, it is expected that students should be able to: · identify some changes that people experience over time – height, weight, color of hair. · predict how their own height and weight will change over the school year. · describe how people cause things to change– demolition of buildings, construction of buildings, cutting down trees, planting trees, building highways. · describe how things change naturally. This includes seasonal changes, the growth in seeds and common plants, common animals including the butterfly, and the weather. · identify examples of fast changes and slow changes. Slow changes should be the kinds of familiar changes that occur over weeks, months, or seasons. Students are not responsible for long-term changes. · create a question about some change they have observed.

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Science Strand

Resources

The strand focuses on student understanding of the role of natural resources and how people can utilize those resources in a sustainable way. Resource management is an important idea developed within the strand. This begins with basic ideas of conservation and proceeds to the more abstract consideration of costs and benefits in the 6th grade. The topics developed include the conservation of household materials, the importance of soil and plants as resources, energy use, water, Virginia's resources, and how public policy impacts the environment. This strand includes science standards K.10, 1.8, 2.8, 3.10, 3.11, 4.8, and 6.11.

Strand: Resources

Standard K.10

The student will investigate and understand that materials can be reused, recycled, and conserved. Key concepts include

- identifying materials and objects that can be used over and over again;
- describing everyday materials that can be recycled; and
- explaining how to conserve water and energy at home and in school.

Understanding the Standard

Standard K.10 focuses on student understanding that materials can be reused, recycled, and conserved. This should include common objects and materials found in the school and home environment. K.10 establishes a foundation for increasingly advanced conservation concepts developed in the primary standards. Note that science standard 1.8 is very closely related to K.10. It is intended that students will actively develop science investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

Standard K.10

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: · Natural resources such as water and energy should be conserved. · Recycling helps to save our natural resources. · Recycling, reusing, and conserving helps preserve resources for future use.	In order to meet this standard, it is expected that students should be able to: · give examples of objects that can be recycled. · identify materials that can be reused. · describe the difference between recycle and reuse. · name ways to conserve water and energy. · describe how to recycle a given material – paper, oil, aluminum, glass and plastics. · predict what would happen if recycling and reusing were not practiced.